

## CORRELATION ANALYSIS BETWEEN FACTORS INFLUENCING THE USAGE INTENTION OF NFC MOBILE WALLET PAYMENT

R. Al-Amri<sup>1</sup>, N. Maarop<sup>1,\*</sup>, R. Jamaludin<sup>2</sup>, G. N. Samy<sup>1</sup>, P. Magalingam<sup>1</sup>, N. H. Hassan<sup>1</sup>, D. W. H. Ten<sup>1</sup>, S. M. Daud<sup>1</sup>

<sup>1</sup>Advanced Informatics School, Universiti Teknologi Malaysia (UTM)

<sup>2</sup>Razak School of Engineering and Advanced Technology, UTM

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### ABSTRACT

The dramatic increase in the development of mobile technologies and the rising expansion of smartphones usage have results with vital opportunities for innovative corporations to develop new payment systems that offer consumers with value-added services. Near Field Communication (NFC) mobile payment system is becoming one of the highly noticeable phenomena that is capable of turning users' smartphones into digital wallets. Even though a lot of research has been conducted to address the consumers' adoption of mobile payment, there are only few researches that have touched the user's adoption of NFC mobile wallet from the human and security perspectives. The aim of this study is to analyze the factors influencing the consumers' adoption of mobile payment. The study proposed a model that defines the dimensions of perceived security for NFC mobile payment to build understanding on how to improve the adoption rate of the technology. The model conceptualized two main dimensions containing eight independent factors namely, Perceived Ease of Use, Perceived Usefulness, Ubiquity, Awareness, Perceived Risk, Structural Assurance, Security and Privacy, and Trust.

Author Correspondence, e-mail: [nurazean.kl@utm.my](mailto:nurazean.kl@utm.my)

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The study conducts a survey questionnaire that involves 209 valid respondents to evaluate the proposed conceptual model. Finally, the result of the correlation analysis shows that all the independent variables (Perceived Ease of Use, Perceived Usefulness, Ubiquity, Awareness, Perceived Risk, Structural Assurance, Security and Privacy, and Trust) have significant influence on the dependent variable (Intention to Adopt NFC Mobile Wallet Payment).

**Keywords:** NFC; Mobile Wallet; Technology Adoption; Human and Security Perspective.

## 1. INTRODUCTION

Mobile phones have recently played an important and significant role in our life. We have utilized the mobile technology not only for communication but also for other services that allow information distribution and exchange such as mobile commerce, mobile identity and mobile payment [1][2]. Mobile phones have also gained a global interest especially after introducing the NFC technology that opens up various opportunities to enable mobile users to use their mobile devices for payment in retail stores, ticketing counters, access control and other aspects of their daily life [3][4].

Mobile wallet is one of the technologies that utilizes NFC chip through smart phones to enable users to perform safe and secured financial transaction [5]. Mobile wallet is a promising and exciting domain that has been rapidly developing recently, and even though it's still considered in its beginning stage, great hope and future is put on it globally [6]. NFC technology has introduced an easy and effective method of payment. Nevertheless, this technology is still having some security concerns leading to a slow pick up of adoption among users [7].

Even though, NFC mobile wallet is considered easy to be used and it comes with a range of benefits to consumers, its adoption within the Malaysian consumers are still at the beginning stage and the adoption rate in Malaysia compared with other countries is comparatively lower [1]. It is essential to convince consumers to adopt the NFC mobile wallet payment system as stakeholders have spent vast amount of money to build up its infrastructure [1]. Thus, this study is carried out with the aim to identify the factors influencing Malaysian consumers' adoption of NFC mobile wallet payment from the human and security perspectives.

## **2. LITERATURE REVIEW**

### **2.1 NFC Mobile Wallet Payment**

Mobile wallet is one of the greatest benefits of smartphones that utilized the technology of NFC chip inside the smartphones to allow the customers to make in-store payments quickly and securely without having to deal with cash or locate credit or debit cards [8][9].

Near Field Communication (NFC) is known as a communication channel between devices known as (Initiator and Target) that uses a Radio Frequency (RF) signals of 13.56 MHz, with a bandwidth not more than 424 Kbits to exchange data in short-range of 5cm by generating a peer-to-peer wireless communication [10].

Mobile Wallet is defined as an application stored in smartphones enabling consumers to perform various mobile financial transaction [11]. Mobile wallet is basically the use of a mobile phone for financial transactions between two devices known as sender and receiver to purchase goods or pay bills [12].

### **2.2 Theoretical Review of Models of Secure Mobile Payment**

Theory model proposed by Yan and Yang [13] stated that perceived ease of use (PEU), perceived usefulness (PU), structure assurance (SA) and ubiquity (U) have important effect on users' trust that respectively affect users' usage intention. Therefore, it is vital for mobile service providers to give more attention toward trust to ease the users' adoption of mobile payment services [13].

In addition, Pham and Ho [7] also mentioned that the users' intention to adopt NFC mobile payment systems is affected by product-related factors (PEU, PU, compatibility (C), perceived security (PS) and privacy risk (PR), trialability, perceived cost of use (PCU) and additional value of NFC mobile payment), trust-based factors, personal-related factors (personal innovativeness in new technologies, absorptive capacity), and attractiveness of alternatives [7].

Furthermore, Negash [14] emphasizes that customers' intention of using mobile banking is alike to their intention of using Internet banking [14]. Technology acceptance model (TAM) is being used in many Internet banking research and yet it the model has been receiving a significant consideration and empirical support within researchers [14]. However, in this study the author has extended the TAM2 model and he came up with a model that consists of seven constructs, which are PEU, PU perceived enjoyment (PE), mobile network quality

(MNQ), security and privacy (SR), trust (T), awareness (A), and finally regulation and compliance (RC) [14].

Moreover, Ting, Yacob, Liew, and Lau, in their theory model [15] stated that the intention toward adopting mobile payment system is affected by some belief factors related to the theory of planned behavior TPB. The authors decomposed salient beliefs into factors based on previous research and they came up with three main factors named as behavioral belief (PEU, PU, T and perceived safety), normative belief (interpersonal influence and external influence) and finally, control belief (self-efficacy and facilitating condition) that have a significant effect on the users' intention to adopt mobile payment system [15].

### **2.3 Concluding Results**

Despite the fact that a wide range of research has been conducted on the consumer acceptance of mobile payments, only few of them have touched the adoption of NFC mobile wallet payment from the human and security perspectives. Therefore, the study proposed a conceptual model that consists of two main dimensions containing eight independent factors for the secured NFC mobile wallet payment. These eight factors were identified from four related model done by the following researchers, Yan and Yang[13], Pham and Ho [7], Negash [14], and Liu, Ting, Yacob, Liew, and Lau [15]. Theory model by Pham & Ho [7] was chose as a based model of NFC mobile wallet payment, which consist of PEU, PU, PR, and T. However. The theory did not consider U, A, SA and SR as factors influencing the adoption of NFC mobile wallet payment. Table 1 shows the result of review conducted. The table, represents the factors influencing the adoption of NFC mobile wallet payment from the human and security perspectives.

**Table 1.** Factors influencing the usage of NFC mobile wallet

Factors	Authors
1- Perceived Ease of Use	[7],[13],[14],[15]
2- Perceived Usefulness	[7],[13],[14],[15]
3- Ubiquity	[13]
4- Awareness	[14]
5- Perceived Risk	[7]
6- Structural Assurance	[13]
7- Security and Privacy	[14]
8- Trust	[14],[15]

### 3. PROPOSED CONCEPTUAL MODEL

Theory model by Pham & Ho [7] is the base model of the proposed conceptual model since it is the most related model among all models discussed [7]. In this proposed model, some additional factors will be included to the base model. On the other hand, factors that are beyond human and security perspectives will be excluded, as the core aim of this research paper is to enhance the adoption rate from the human and security perspectives.

In conceptualizing the model of interest, two main dimensions have been proposed containing eight independent factors of the NFC mobile wallet payment, and these are:

#### 3.1 Human Factors

One of the major dimensions influencing the intention to adopt NFC mobile wallet payment is from the human perspective that includes four main factors, which are perceived ease of use, perceived usefulness, ubiquity, and finally awareness.

##### 3.1.1 Perceived Ease of Use

An easy to use mobile payment system with user-friendly interfaces and powerful navigation will demonstrate the service providers' ability and benevolence, hence earning consumers' trust. In other words, PEU is a perception about operating a technology with minimum efforts [7][13][14]. This indicates that PEU is predicted to have a positive influence on consumers' perception of credibility in their interaction with mobile payment systems [15].

### 3.1.2 Perceived Usefulness

PU is known as the degree to which an individual believes that using a specific system would enhance his/her job performance and it will provide him or her with new features that secured and facilitate the performance [7][13][14]. The ultimate reason for exploiting mobile wallet payment systems among mobile users is the fact of finding the systems useful during the process of settling payment transactions [15][16].

### 3.1.3 Ubiquity

Ubiquity refers to the concept in which users are capable of accessing mobile payment system at anytime and anywhere. Ubiquity is one of the core advantages of mobile payment compared to traditional and online payment systems. Therefore, ubiquity is found to have a positive effect on users' trust on a service provides and yet reflect on improving the adoption rate of a new technology [13].

### 3.1.4 Awareness

The adoption of NFC mobile payment is determined by the customers' awareness about the vulnerabilities of such technology and the awareness level on how to mitigate those vulnerabilities. Furthermore, awareness is considering the first line of defense in mobile security as it prevents a great number of threats. Thus, consumers' awareness leads to higher rate of adoption toward the technology [14].

## 3.2. Security Factors

Another major dimension influencing the adoption level toward NFC mobile wallet payment is from the security perspective that includes four main factors, which are perceived risk (PR), structural assurance (SA), security and privacy (SP), and finally trust (T).

### 3.2.1 Perceived Risk

Mobile banking services are found to be riskier than banking services as mobile services are rated to have high level of uncertainty [17]. Prior research revealed that PR is considered as a major factor in causing customers not to adopt mobile payment systems [18]. Therefore, PR play a key role in determining the intention to use NFC mobile wallet payment system among consumers [7] [16][17].

### 3.2.2 Structural Assurance

SA as an institution-based trust mechanism is capable of building consumers' trust effectively and decline their PR [13]. SA means that there are some existing adequate

technological and legal structures to guarantee the payment security. Therefore, if there are enough existing SA such as certification and regulations to guarantee payment security, consumers can build their trust in mobile payment [19].

### **3.2.3 Security and Privacy**

Customers will not adopt NFC mobile wallet payment unless it is safe and secure. In the same time, customers are so concern about their privacy and they are anxiety that the rise of “mobile wallet” technology will leave them with more vulnerable than ever to attacks such as identity theft and invasive data collection. PS were found to be important obstacles toward the consumers’ adoption of NFC Mobile wallet payment [14][16][18].

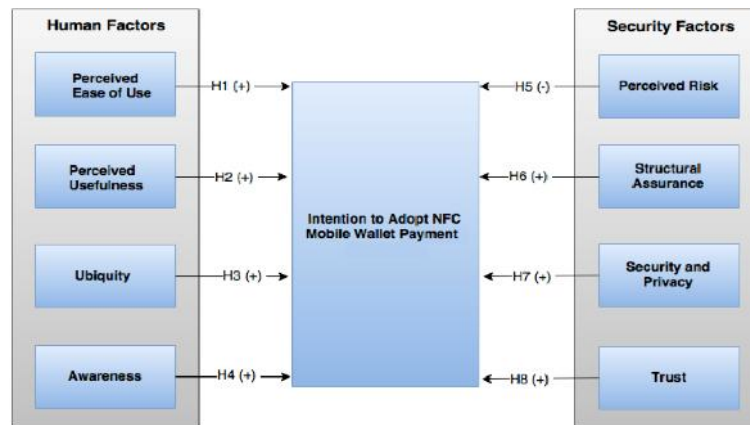
### **3.2.4 Trust**

Trust refers to the concept of a willingness to be vulnerable to other’s actions. This is established upon the expectations that the others will act in a responsible manner [14][15]. Trust ensures satisfactory expectations that the mobile payment system is reliable and predictable and that no dangerous consequences will happen while using it [14][15][20].

## **3.3 Formulation of Hypotheses**

The proposed conceptual model derived from a consideration of integrated previous related models. In particular, this study aims to extend the previous adoption model of NFC mobile payment by considering two aspects namely the human and security perspectives. Hence, this study is also considering other important factors related to secure use of NFC mobile payment, which will then improve the adoption rate. These factors are:

Human factors that include PEU, PU, ubiquity, awareness, and security factors that include PR, SA, SP and trust. All the factors are identified to influence the consumers’ intention to adopt NFC mobile wallet payment. The final proposed conceptual model is illustrated in Figure 1.



**Fig.1.** Proposed Conceptual Model

Hence, eight hypotheses have been constructed in this study. The research hypotheses of the proposed factors towards secure NFC mobile wallet payment are as follow:

**H1:** Perceived ease of use has a positive effect on consumer intention to adopt NFC mobile wallet payment.

**H2:** Perceived usefulness has a positive effect on consumer behavioral intention to use NFC mobile wallet payment.

**H3:** Ubiquity positively affects user trust, which leads to users' adoption of NFC mobile wallet payment.

**H4:** Awareness about the vulnerabilities of NFC mobile payment has a positive effect on consumer adoption for the technology.

**H5:** Perceived risk of using NFC payment has a negative effect on the intention to adopt NFC mobile wallet payment.

**H6:** Structural assurance positively affects user trust on NFC mobile wallet payment, which improves their intention to adopt the technology.

**H7:** Security and privacy have a positive effect on consumer intention to adopt NFC Mobile wallet payment.

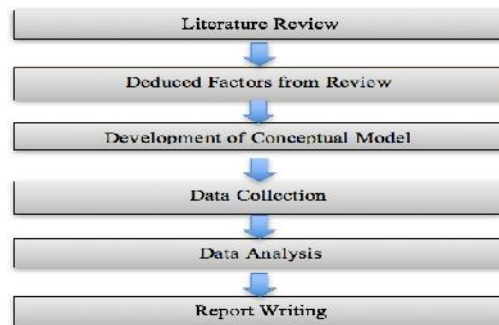
**H8:** Mobile payment trust has a positive influence on the consumers' attitude toward adopting NFC Mobile wallet payment.

#### 4. Proposed Methodology

The research will be conducted using the quantitative method with the use of questionnaire survey that will focus on obtaining statistical findings among bank users on the factors that



influence the adoption of NFC mobile wallet. A random selection of users will be performed to evaluate the proposed conceptual model in explaining the usage intention toward NFC mobile wallet payment system.



**Fig.2.** Research Design

The population of this study will be bank users who have the intention of using mobile wallet with the use of smartphone in Kuala Lumpur – Malaysia. The sampling type in this study is a probability sampling. The sample size has been determined to be 209 samples. The reason for choosing respondents size was to get a correlation of .1 and a critical point of stability (POScrit) of 95% of confidence and a widths (w) of .15 based on the sample size selection table provided by Schönbrodt & Perugini [21]. The data analysis of the obtained information would be via the software SPSS version 22. Various statistical analyses such as descriptive, correlation and regression testing will be performed to test the obtained data.

## 5. RESULTS

A total of two hundred and fifty questionnaires were distributed, a total of two hundred and twenty-one responses have returned back, and twelve responses were excluded. Hence, a total of two hundred and nine valid responses are the selected sample size of the analysis. Cronbach's alpha ( ) was used to measure the reliability of the instrument items.

**Table 2.** Cronbach Alpha and Overall Mean

<b>Variables</b>	<b>Cronbach Alpha Value</b>	<b>Overall Mean</b>
Perceived Ease of Use	0.845	4.07
Perceived Usefulness	0.774	3.92
Ubiquity	0.756	3.95
Awareness	0.782	3.90
Perceived Risk	0.901	2.41
Structural Assurance	0.728	3.71
Security and Privacy	0.753	3.9
Trust	0.859	3.86
Intention to Adopt NFC Mobile Wallet Payment	0.789	4.08
All Variables	0.908	3.75

Cronbach Alpha minimum level 0.7

Based on the results in Table 2, participants stated high level of scores toward perceived risk followed by trust respectively and low level of scores toward structural assurance. Correlation analysis is performed to specify the direction and strength of the linear relationship between the variables. Pearson correlation coefficient can vary from -1 to +1. Positive sign implies a positive correlation between two variables meaning that if one variable increase, so will the other. Simultaneously, negative sign indicates negative correlation between two variables meaning that if once variable increase, the other will decrease and value between 0 and 1 represents the strength of the relation. A correlation of 0 indicates no relationship between two variables [21].

Table 3 determines the correlation between all the variables of the proposed conceptual model using Pearson's correlation coefficient ( $r$ ) in order to measure the level of association between two variables. As a conclusion, all proposed hypotheses are accepted in this study.

**Table 3.** Correlations of Factors

	N	EBI	Correlation Medium & Significance
PEU	Correlation Sig. (2 tailed)	.975** .000	Very Strong Positive
PU	Correlation Sig. (2 tailed)	.696** .000	Strong Positive
U	Correlation Sig. (2 tailed)	.712** .000	Strong Positive
A	Correlation Sig. (2 tailed)	.740** .000	Strong Positive
PR	Correlation Sig. (2 tailed)	-.301** .000	Weak Negative
SA	Correlation Sig. (2 tailed)	.235** .000	Weak Positive
SP	Correlation Sig. (2 tailed)	.466** .000	Moderate Positive
T	Correlation Sig. (2 tailed)	.609** .000	Strong Positive

\*\* . Correlation is significant at the 0.01 level (2-tailed).

The study results demonstrated that the eight factors have a vital influence toward the adoption of NFC mobile wallet among users in Kuala Lumpur – Malaysia. The independent variables show a significant relationship with the dependent variable. The results showed that the eight hypotheses proposed were supported and accepted. Seven hypotheses showed a medium positive correlation value influence the intention to adopt NFC mobile wallet proximity payment which are PEU, PU, U, A, SA, SP, and trust. Based on the r value PEU has the highest value correlation (0.975) while SA has the lowest value correlation (0.235) which is still accepted. In addition, PR has a negative correlation with r value of (-0.301) which is also still accepted.

Overall, the result shows that the eight factors have positive significant impact towards the intention to adopt NFC mobile wallet proximity payment among users in Kuala Lumpur – Malaysia.

## 6. CONCLUSION

NFC mobile payment has introduced an easy and effective method of payment. However, the adoption rate of this technology is still slow due to some vulnerabilities and security concerns, which lead users to have negative perceived security for NFC mobile payment systems. As a result of this study, and based on the previous studies it was found that the intention to adopt NFC mobile wallet payment system might be influenced by factors deriving from human and security perspectives. Moreover, the eight hypotheses proposed were found to be significantly influencing the intention to adopt NFC mobile wallet payment system based on the SPSS analysis.

Adoption of NFC mobile wallet is still in its beginning stages. Therefore, further study in the factors influencing the adoption of NFC mobile wallet payment from different perspectives rather than the one presented above it highly recommended as it was widely recognized that users with experience using NFC mobile wallet found it very useful and convenient method of payment. Furthermore, NFC mobile wallet is a vast area and there are main concerns relating to the security aspect of the system especially for NFC technology security issues. Thus, we highly recommend future researchers to focus on these issues.

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